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THE REGIONAL LYMPH GLANDS OF FOOD ANIMALS<sup>1</sup>

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## INTRODUCTION

Intelligent and final judgment of the fitness or unfitness of meats for human consumption is based largely on the conditions found in the lymph glands of the slaughtered animals. It is important, therefore, that persons engaged in meat inspection should have an intimate knowledge of the topographical anatomy of the lymphatic apparatus of animals the flesh of which is used for food. While much of the information here presented has been gleaned from various works on the subject, this has been supplemented by first-hand, practical experience, as well as by original research, including dissections of tissues and injections of lymph radicles and larger vessels.

<sup>1</sup> This publication is a revision of an article which appeared in the Twenty-seventh Annual Report of the Bureau of Animal Industry (1910) and was also issued in separate form as Bureau of Animal Industry Circular 192.

## DESCRIPTION OF THE LYMPHATIC SYSTEM

The lymphatic system presents for study the lymph and its cellular constituents, the lymph vessels and lymph glands, together with certain accessory lymphatic structures which form a part of the system.

## THE LYMPH

The lymph itself is identical with the plasma of the blood and contains cellular elements which vary much at different periods and in different parts of the animals at the same time. In the intercellular lymph spaces and in the finest lymph radicles it has a poor cellular content, while it possesses rich cellular contents as it leaves the lymph glands. These cellular elements are variously classified by different histologists, one of the most convenient classifications being that based on their size, form of nucleus, and structure, into large lymphocytes, small lymphocytes, polynuclear leucocytes, and transitional leucocytes. According to their granules and their staining characters they are classified as eosinophiles (or oxyphiles), basophiles, and neutrophiles.

## THE LYMPH VESSELS

The lymphatic apparatus in a normal, healthy individual is made up of a system of tubes or conduits, sometimes designated the white blood vessels, beginning as terminal culs-de-sac in the tissue interspaces, and coursing as intricate and extensive networks in practically all tissues except muscle bundles, intermuscular sheaths, nerves, and blood vessels. The system terminates finally as two large lymph vessels, known as the thoracic duct and the great lymphatic vein, which empty into the blood vascular system near the junction of the jugular veins in the anterior vena cava.

Within the lymph vessels are situated involutions of the endothelial lining, forming valves which correspond to and resemble the valves of the veins, though they are much more numerous than in the veins. The smallest lymph vessels, i. e., the lymph capillaries, do not contain valves, nor are valves at all numerous in the thoracic duct, although several do exist at its juncture with the veins, forming a contrivance to prevent passage of blood backward into the thoracic duct. But in all the vessels of an intermediate size the valves may readily be seen in injected preparations as constricted nodes about one-sixth of an inch apart.

In many respects the lymph vessels simulate the veins of the blood vascular system in both structure and function. They are, in fact, adjuncts of that system.

The capillary lymph vessels are formed by a single layer of endothelial cells, as are the smallest of the blood capillaries, and are said to have their origin in closed terminal culs-de-sac instead of in open, intercellular, lacunar spaces.

Besides possessing valves the intermediate and large lymph vessels are made up of three coats, as are the veins (an inner endothelial, a middle muscular, and an outer connective-tissue envelope), and are said to divide about equally with the veins the absorbent functions. It is to be noted that those lymph channels of large size also possess

elastic fibers, which act in a mild degree for the impelling of the lymph on toward the blood.

The lymph collected by the lymphatics from all parts of the body is finally emptied into the blood stream through the agency of the two large vessels already mentioned—the thoracic duct and the great lymphatic vein.

The thoracic duct has its origin in a very irregularly shaped cystic dilation known as the reservoir of Pecquet, or the receptaculum chyli, situated beneath the first lumbar vertebra, near the adrenals. From this origin it extends forward through the diaphragm (in cattle by a special opening), passing along the lower surface of the dorsal vertebrae and above the aorta to the apex of the thorax, and empties into the anterior vena cava. This duct receives the lymph from all parts of the body except the right fore limb and the right half of the head, neck, and thorax. The thoracic duct is sometimes double throughout its extent, originating in the one reservoir and emptying at the junction of the two jugulars.

The great lymphatic vein, or the right lymphatic vein, is an extremely short trunk which receives the lymph from the right side of the head, neck, thorax, and right fore limb and empties into the venous system at the junction of the jugular veins or anastomoses with the thoracic duct just above the point of juncture with the anterior vena cava. It is formed by the efferents of the prepectoral glands of the right side.

#### THE GLANDS

On the course of the lymph vessels are interpolated adenoid structures called lymph glands. The glands are nodular organs, varying in size from almost imperceptible points to that of a hen's egg, and varying also in different species of animals. In form they may be flattened, round, cylindrical, or reniform (kidney shaped). Usually, however, they are more or less reniform. The lymph vessels approaching a gland enter, after breaking up into many branches, in an oblique direction on its convex border and are known as the afferent vessels. These are the conduits that convey the lymph directly from the various tissues to the respective or corresponding lymph glands. After having traversed a complex labyrinth of channels in the gland and having its composition altered both chemically and histologically, the lymph leaves the gland by the efferent lymph vessels which have their origin at the hilus of the gland, situated on its concave border. These efferent vessels either enter into another gland or pass directly to the receptaculum chyli, the thoracic duct, or the right lymphatic vein.

An idea of the structure of a gland may be had from a study of the lymph follicles in the walls of the intestines, and then of a plexus of lymph vessels, within the meshes of which are placed these simplified collections of germinating lymphatic cellular elements.

A lymph follicle as found in the intestinal mucosa is nothing more than a small, round aggregation of proliferating lymph cells held in an extremely delicate stroma of adenoid, connective tissue and penetrated by a richly arborescent capillary arterial twig which furnishes it nutriment. Surrounding some of these aggregations of lymphatic cellular elements is an extremely delicate connective-



tissue capsule opening into and continuous with the surrounding lymph capillaries, much on the order of a Bowman's capsule covering a Malpighian corpuscle in the kidney.

The lymph gland may be considered as nothing more than a large collection of these simple lymph follicles held together by a connective-tissue framework containing trabeculae which separate the follicles and surrounded by a thick capsule from which the framework takes its origin. In the lymph glands of some of the lower animals involuntary muscle fibers are intermixed with the fibers of connective tissue. The individual follicles of this compound gland do not completely fill the alveoli formed by the trabecular framework, but are surrounded in each instance by a hollow space which corresponds to the space between the capsule mentioned above as surrounding a solitary follicle and the follicle itself. In the compound lymph gland these spaces are continuous with one another toward the medullary portion of the gland. The follicles of the medullary portion are elongated structures and are known as the medullary cords. The intercommunicating follicular lymph spaces finally are continuous with the efferent lymph vessels of the gland.

For convenience of description the structure of lymph glands is usually described as being divided into a cortical and a medullary portion, the only difference in the two being in the shape of the lymph adenoid structures; those in the cortical portions are round and called cortical follicles, and those in the medullary portion are elongated and known as medullary cords. The spaces surrounding the follicles and cords are known as the lymph sinuses, and it is through the sinuses that the lymph passes on its way from the afferent to the efferent lymph canals. It is while traversing these tortuous sinuses that the lymph is altered in composition.

From the standpoint of meat inspection it is well to remember that foreign and deleterious matter that has been taken up by the lymph on its passage through the different tissues is oftentimes removed or destroyed either by a process of filtration or by chemical counteraction. This function of the gland is very important, as certain deleterious substances, such as infectious microorganisms (tubercle bacilli for a specific example), if emptied unceremoniously by the lymphatics into the blood stream would probably be distributed throughout the whole system and would be likely to set up a generalized infection—a septicemia—which would probably soon terminate in death. The lungs, of course, filter out many germs that are thus emptied into the blood stream.

The bacteria filtered out or retained temporarily by lymph glands are often destroyed and disintegrated. That is not always the case, however, and bacteria may even pass through a lymph gland without leaving any trace of their passage. Many of the bacteria which are retained are chemically treated and disintegrated, or, not being destroyed, they produce disease of the glands. Other substances, such as particles of carbon, are filtered out and may be readily seen in the bronchial glands of nearly all old animals. Blood and other tissue pigments are seen in the glands where there has been a destruction of these tissues upstream. Parasites, too, are at times found in these structures.

The lymph as it leaves the gland is much altered. It is in the gland that some of the lymph corpuscles, which play such an extremely important part in the protection of the body from infections and injuries, are added to it. It is while thus passing through that the lymph acquires its property of coagulability, i. e., it receives its fibrinogenetic qualities. The lymph with its new qualities and new constituents, together with its load of modified waste from the tissues, is now ready to be emptied into the blood stream, to be passed along to the excretory organs.

The statement that the lymph glands filter out and modify deleterious matters can not be very readily demonstrated by simple macroscopic means in a young, healthy animal, but it is clearly exemplified in cases of infections of individual organs and regions and in old animals where pigmentation of these glands is often observed. It is on such findings that the meat inspector is most often obliged to depend for basing his opinion of health or disease, and for deciding localization or generalization of disease and the fitness or the unfitness of meat for food purposes.

If the lymphatic system is the "scavenger of the body," if it protects the body from disease, it also furnishes a route of entry for disease, and in certain cases acts as a disseminator of disease. Those cancerous affections and infectious diseases of a malignant character which by intent or chance have become inoculated into the body are not long held in abeyance by the lymph glands, for in such cases the lymph conduits act as ways of transport, to the detriment of the whole body.

In consistence, size, and color the lymph glands vary considerably. In young, rapidly growing animals the glands are rather prominent and juicy; in old and mature animals they are more firm and compact. Sometimes in old milk cows the lymph glands may be rather prominent, but they are usually fibrous in texture. The splanchnic lymph glands are softer in structure than those in other parts of the body, those of the abdominal digestive organs being more juicy, especially during absorption from the intestines.

The interior parts of the mesenteric glands are usually darker in color than those of other regions. The colors that prevail are white, light gray, dark gray, mottled gray and brown, light brown, and sometimes red or even black.

The red lymph glands usually represent a special kind of gland known as hemolymph glands, the color being due to the presence of red blood cells in the sinuses. These are quite normal glands, and are thought by some to be transitional forms, or forms induced by alterations in other organs, especially the spleen, and by others are supposed to relieve the spleen of a part of its function in the metabolism of the blood. These small red glands usually occupy a position in the sublumbar region and are designated by Warthin as "spleen-olymph glands" and "marrowlymph glands."

Black lymph glands, or mottled black and white, while not normal, can not be said to be always really diseased, since the color may be due to a mere deposition of normal pigment or to carbon particles which have no special significance, at least from a meat-inspection standpoint. The cortical portions of many lymph glands are white or light gray, while the medullary portions are rather dark in color.

In many old animals the lymph glands are fibrous in texture, and on section are of a yellowish-white color.

Although the routes of the lymph conduits are more or less constant, there may easily be diversions of the normal or usual flow of lymph, due to various causes, the most important being the retrograde movements, due to blocking of the lymph channels in disease, as in cancerous and other conditions. Anastomoses of lymph vessels of adjacent regions may occur, as in inflammatory adhesions of one lobe of the lung with an adjacent lobe, or adhesion between the visceral and parietal or the visceral and mediastinal pleura, etc. All such points must constantly be kept in mind in order to render intelligent judgment in a seemingly unexplainable finding.

The discussion of the various glands will proceed somewhat in the order of examination of the carcass as conducted at the time of evisceration or, following the plan of inspection, by passing from terminal to central lymph structures as the lymph flows.

### THE SUBMAXILLARY LYMPH GLANDS

The submaxillary lymph glands in cattle are located superficially in the lower portion of the inferior maxillary space, between the inner aspect of the inferior maxillary bone and the submaxillary salivary glands, about 2 inches anterior to the point where the lower border of the inferior maxillary bone curves abruptly upward and above the anterior attachment of the sternomaxillaris muscle. Usually there is but one node on each side, but at times there are two glands lying very close to each other. (Fig. 1, 4, and fig. 2, b.)

In hogs, these glands, covered by the salivary glands, lie more posteriorly than in cattle. (Fig. 3, 9.)

Their afferent vessels, chiefly superficial, are derived from the mucous membrane of the anterior nares, the muscles of the lips, cheeks, and tissues of the anterior maxillary space, and from the anterior portion of the tongue. The outgoing lymph vessels pass to the superior cervical lymph glands.

When cattle are butchered the head is usually severed from the carcass without removing the tongue and is so inspected after being placed face downward on a metal head-inspection rack. The tongue is loosened from its anterior attachments and forcibly pulled backward so as to hang free except for the attachments at the base of the cranium. When this is done the submaxillary lymph glands will be exposed or only slightly covered with fat on each side of the base of the tongue and may be easily incised for inspection.

If inspection is to be made without thus loosening the tongue, a longitudinal incision should be made along the inner border of the sternomaxillaris muscle just within the lower border of the inferior maxilla, when the gland will be easily found adjacent to the submaxillary salivary gland.

In other cases the tongue is removed from the head and hung up by its tip, when the gland may be reached by grasping with one hand the fatty mass located laterally at the base of the tongue, drawing the tissues tense, and making a transverse incision to the side of the sternomaxillaris muscle directly opposite the arytenoid cartilage of



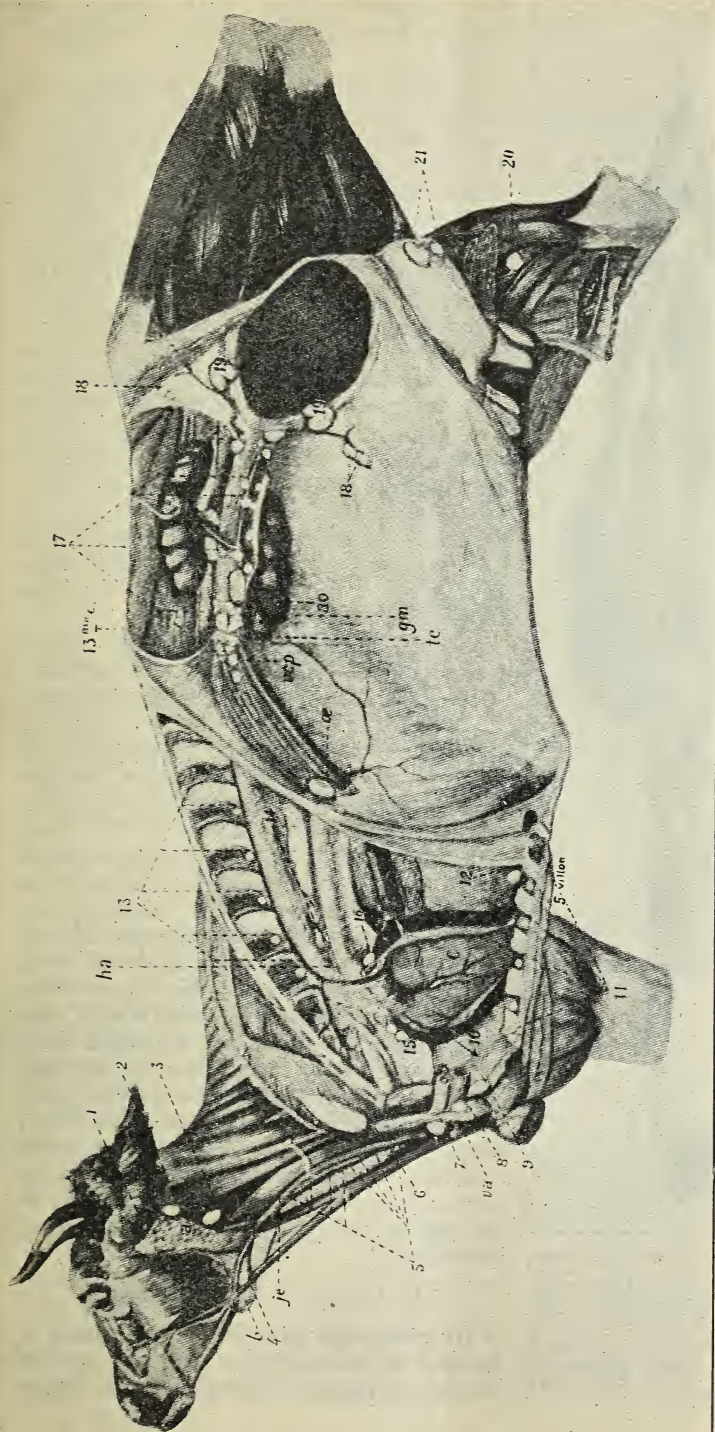


FIG. 1.—Lymph glands in the cow: 1, Parotid lymph gland; 2, atlantal lymph gland, or the most superior of the superior cervical lymph glands; 3, post-pharyngeal lymph gland; 4, submaxillary lymph gland; 5, small glands on the median portion of the superior face of the trachea; 6, prescapular lymph gland; 7, 8, 9, prepectoral lymph glands; 11, inferior thoracic or suprasternal lymph glands situated along the course of the internal thoracic artery and vein; 12, sternodiaphragmatic lymph gland; 13, superior thoracic or subdorsal lymph glands; 14, chain of lymph glands in the posterior mediastinal region; 15, lymph nodes along the inferior surface of trachea in the anterior mediastinal space; 16, posterior bronchial lymph gland, under the bifurcation of the trachea; 17, sublumbar lymph glands, at *cp* the most anterior are at the origin of the celiac arteries; 18, external iliac or circumflex iliac lymph glands, at the angle of the haunch; 19, external iliac lymph glands at the angle of the crural trunk; 20, popliteal lymph gland; 21, superficial inguinal or supramammary lymph glands. (From Aureggio's Album Guide)

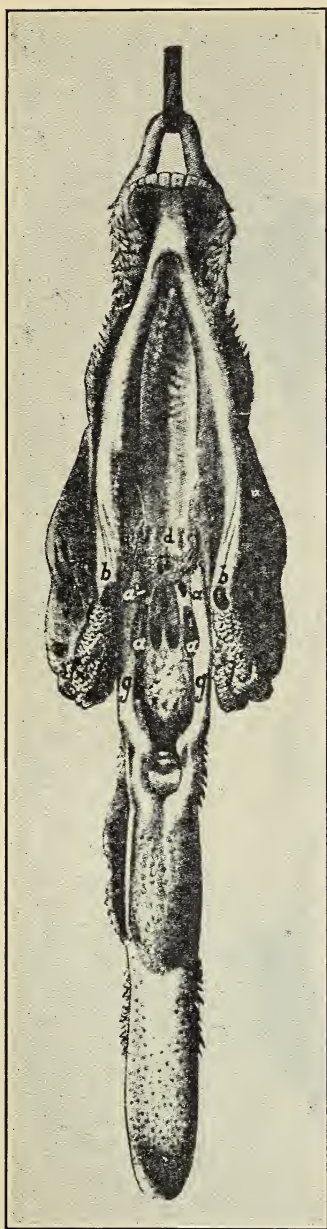


FIG. 2.—Head of cow, with tongue attachments cut and tongue thrown back. *a, a'*, Postpharyngeal or retropharyngeal lymph glands; *b*, submaxillary lymph glands; *c*, tonsils; *d*, posterior nares; *f*, submaxillary salivary gland; *g*, styloid process of hyoid bone. (From Edelmann's Meat Hygiene)

the larynx, which will expose the submaxillary lymph gland for inspection.

In hogs the method of reaching the submaxillary lymph glands (figs. 3, 9) varies with the system of slaughtering. In many of the smaller establishments where the killing is carried on slowly and the inspection is conducted by one inspector at the evisceration bench, it is the custom of the butcher to remove the liver, lungs, heart, and tongue without separating them. In this case the submaxillary lymph glands likely will be removed from the carcass, attached to the tongue, if a good wide incision has been made. Both sets of glands may then be readily located embedded in the fat, on each side of the base of the tongue. It is necessary to distinguish between the lymph glands and the salivary glands, as they lie adjacent and both are removed by this method.

In the larger establishments, where the killing is conducted more rapidly, these glands are examined by a separate inspector prior to the evisceration process. After the hog is shaved and cleaned on the hanging rail a butcher disarticulates the head at the occipito-atloid articulation, leaving the head hanging free from the carcass except for a small attachment by the skin of the neck. This leaves the submaxillary lymph glands plainly exposed at the base of the tongue just inside of each angle of the lower jaw. Most inspectors use a small hook with which the salivary gland is drawn outward and twisted slightly, thus allowing the adjoining lymph gland to be exposed easily and rapidly with a small incision. Experience and deftness with a knife are both necessary to locate and incise these glands rapidly and accurately, so as not to delay or hinder the killing operations.

#### THE PAROTID LYMPH GLAND

In cattle the parotid lymph gland is located at the superior anterior border of the paratoid salivary gland, being



partly embedded in the salivary gland and partly lying on the masseter muscles about 1 inch in front of and a little lower than the external meatus of the ear. (Fig. 1, 1.)

In hogs the parotid glands, very numerous, large, and red in color, are arranged in a chain along the anterior border of the parotid salivary gland and posterior to the border of the inferior maxillary bone. (See fig. 3, 1 and 1'.) On the killing beds it will be noticed, in that method of slaughter where the jowls are allowed to remain attached to the carcass, that very often one or more of these glands are left intact on the inner surface of the jowl after the head is removed. Where the jowls are removed from the carcass with the head, these glands may often be easily seen, as they are frequently cut through when the head is severed from the body. In some cases they may be entirely removed with the head and jowls, or in others they may remain in the carcass, depending entirely on whether the head is cut off long or short.

The afferent vessels, chiefly of the deep variety of lymphatics, are derived from the anterior and lateral portions of the head and from the temporal and parotid regions, the cranial cavity, the base of the cranium, the tongue, the soft palate, the esophagus, and the larynx. The efferent vessels pass the superior cervical glands.

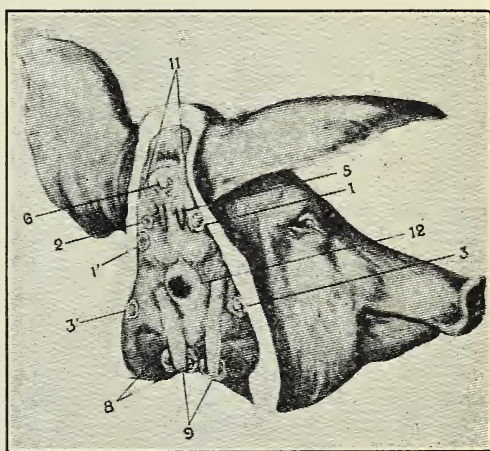


FIG. 3.—Head of hog, showing lymph glands: 1, 1', Parotid lymph glands; 2, postpharyngeal or retropharyngeal lymph glands; 3, 3', superior cervical lymph glands; 8, submaxillary salivary glands; 9, submaxillary lymph gland on each side of the salivary gland in the intermaxillary space. (From Aureggio's Album Guide)

#### THE POSTPHARYNGEAL LYMPH GLANDS

In cattle the postpharyngeal or retropharyngeal lymph glands are located at the base of the cranium just superior to the pharynx, lying close together on each side of the median line between the branches of the hyoid bone. (Fig. 1, 3, and fig. 2, *a* and *a'*.) These glands consist of two very large nodes, one on each side.

In hogs they are usually very small and are situated more posteriorly than in cattle, on the lateral plane of the larynx and the pharynx at about the lower end of the styloid process of the occipital bone. (Fig. 3, 2, and fig. 4, 24.)

They receive lymph radicles from the posterior nares, the cranial cavity, the posterior portion of the oral cavity, the tonsillar region, and the pharynx, also from the other lymph glands of the head. The tonsils, in cattle at least, have four or five large ducts that empty directly into the postpharyngeal glands.

The efferent lymph vessels pass to the other superior cervical glands that lie above the pharynx but are more posterior and external

to the hyoid bone—the parapharyngeal glands—after which they pass down along the trachea, following the carotid artery to the middle cervical glands.

It will readily be seen how very important these glands are, from a meat-inspection standpoint, as they receive most of the efferent lymph radicles of the entrance to both the digestive and the respiratory tracts. Indeed, it is a matter of fact that these glands are often the very first to show tuberculous infection. And, too, those animals affected with actinomycosis that have the postpharyngeal glands involved usually show nodules of actinomycotic growth in the lungs. This would appear to indicate that the lymphatics are not always a protective factor in disease, but in this case their efferents possibly furnish a route by which this disease soon gains entrance to the blood and is filtered out in the lungs.

These glands in cattle may be exposed as follows: Where they are examined in the head after its removal from the carcass, but before the tongue is cut out, draw the larynx downward with the hand (or upward and forward when the head is lying face downward, as is ordinarily the case), then make a free transverse incision near the base of the cranium, which will reveal the glands lying on the superoposterior surface of the pharynx. When the tongue is loosened anteriorly at the cleft of the inferior maxilla and drawn backward as previously described with reference to the submaxillary glands, the postpharyngeal glands are plainly exposed to view on the posterosuperior surface of the pharynx, particularly if incised transversely just back of the pharyngeal opening. If the tongue has been cut out and hung up by its tip, it is a very simple matter to examine the glands as they are exposed to view on the wall of the pharynx at the superior part of the base of the tongue. When the pharynx is not opened up longitudinally they lie almost adjoining each other near the median line. If it is opened, as it should be, to clean it of particles of food, mucus, etc., the glands will drop somewhat—one to each side—but will hang in full view at the level of the anterior border of the arytenoid cartilage. This position will of course vary somewhat when the tongue is hung up by its base, as is sometimes done.

In hogs the method of locating these glands is similar to that described for the submaxillary glands, the only difference being the slight difference in location, the postpharyngeals being located in a mass of fat at each side of the larynx and pharynx. The postpharyngeals are not so large or prominent as the submaxillary glands.

#### THE CERVICAL LYMPH GLANDS

The term “cervical lymph glands,” as used in the meat-inspection regulations and reports of the Bureau of Animal Industry, includes the submaxillary, the superior cervical, the postpharyngeal, the parapharyngeal, and the parotid lymph glands. These are very important to the inspector, and it is necessary to examine them carefully. In hogs especially the cervical lymph glands frequently present the first and often the only lesions of tuberculosis found in the entire carcass.



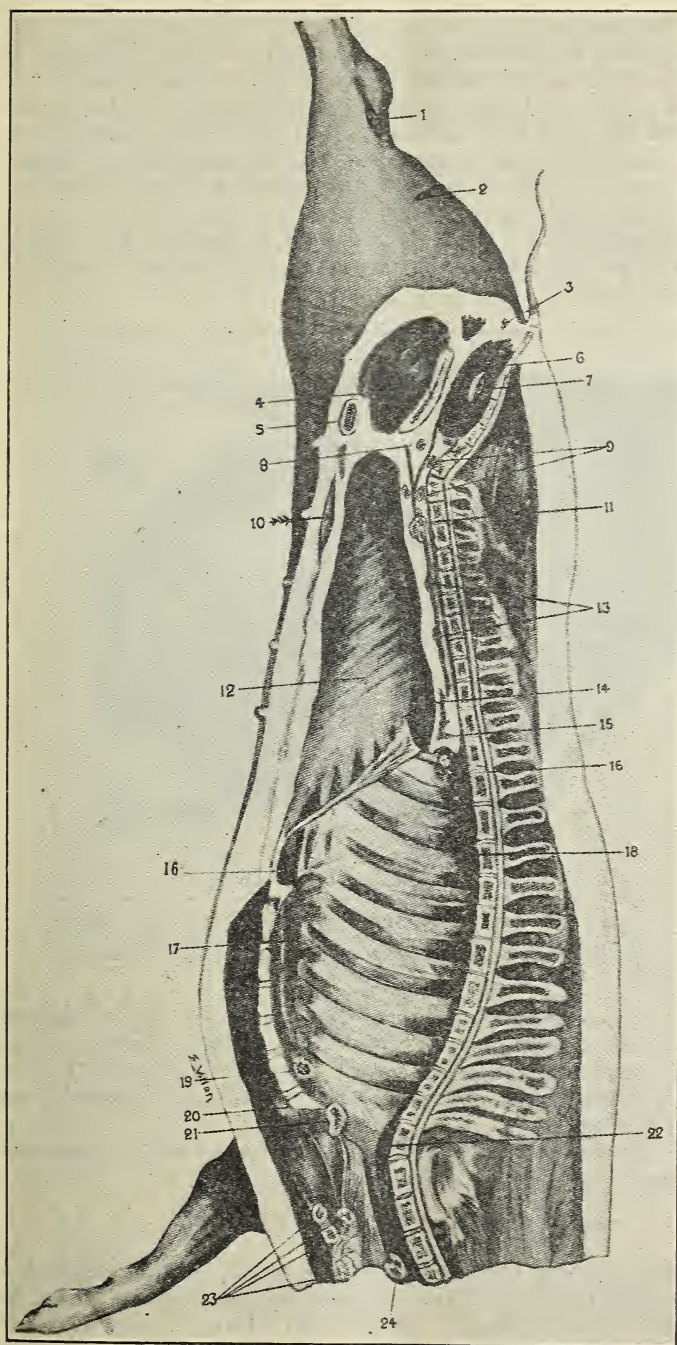


FIG. 4.—Lymph glands in the hog: 1, incision to expose the gland of the neck; 2, popliteal lymph gland; 3, anal lymph gland; 5, superficial inguinal lymph gland; 6, internal obturator muscle; 7, ischial lymph gland; 8, posterior node of the internal iliac lymph glands; 9, subcutaneous lymph glands; 10, incision to expose external inguinal lymph glands; 11, group of lymph glands in the sublumbar region, continuous with the internal iliacs; 13, sternal lymph nodes; 14, kidney; 16a, sternodiaphragmatic lymph gland; 18, small lymph nodes along the aorta; 19, inferior or suprasternal lymph gland; 21, prepectoral lymph glands; 23, glands of the median cervical region, seen usually still attached in the dressed carcass; 24, postpharyngeal or retropharyngeal lymph glands. (From Aureggio's Album Guide)

When tuberculous lesions are found in any of the cervical lymph glands in a carcass that is to be passed for food or cooking, the head and tongue should be condemned and tanked, or may be passed for cooking, depending on the extent and severity of the lesions. If it is passed for cooking all the cervical lymph glands should be carefully trimmed out, and in either case all of the lymph glands of the neck region, including the prepectoral, the prescapular, the middle cervical, and the deep or supplementary cervical glands, should be thoroughly trimmed out and tanked.

Under the designation "the superior cervical glands" are included glands known as "the atlantal," "the parapharyngeal" and "the anterior cervical glands."

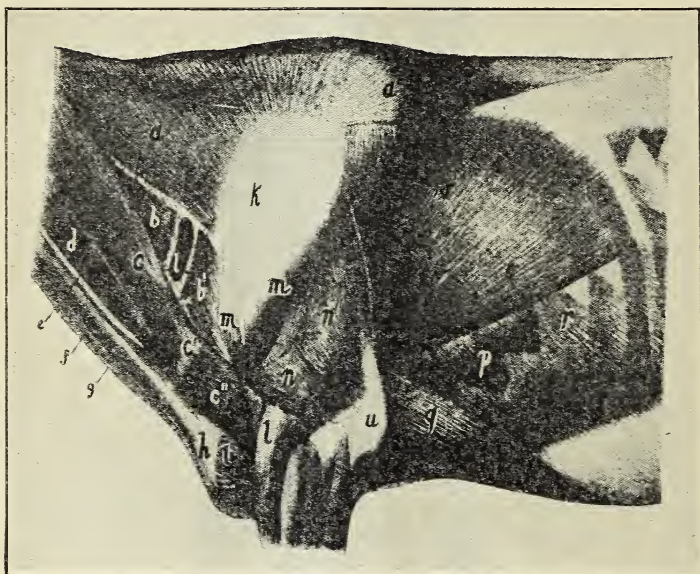


FIG. 5—Left fore quarter of heifer, with exposed prescapular lymph gland: a, a, Cervical trapezius muscle; b, b', omotraversarius muscle; c, c', c'', brachiocephalic muscle; b, prescapular lymph gland. (From Edelmans's Meat Hygiene)

In cattle they are located as the extreme superior end of the submaxillary salivary gland, just under the styloid process of the occipital bone, and bordering the lateral aspect of the occipito-atloid articulation just above the pharynx. They consist of a small group, two or three in number.

In swine "the middle cervicals" form a chain that is continuous with the superior cervicals. (Fig. 4.)

#### THE MIDDLE CERVICAL LYMPH GLANDS

The middle cervical lymph glands are small glands, several on each side, against the wall of the trachea and esophagus, just a little lower than the thyroid gland. (Fig. 1, 5.) Large nodes are never present except occasionally in sheep. It will be found that the efferent lymph vessels of the superior cervical glands pass through the nodes that may be present. These glands receive afferent radicles



from the esophagus and the trachea. Their efferents pass directly to the prepectoral lymph glands. In hogs the middle cervical glands are continuous with the superior cervical chain which extends upward to the occipital bone. (Fig. 4, 23.) In cattle they are often absent.

#### THE PRESCAPULAR OR SUPERFICIAL CERVICAL LYMPH GLANDS

The prescapular or superficial cervical lymph glands are located a little above and inward from the shoulder joint, embedded in a cushion of fat and covered by the mastoido-humeralis muscle. In cattle the gland consists of an elongated voluminous glandular node (fig. 1, 6, and fig 5 of 7); in hogs, a more or less completely fused chain. These glands play an important part in deciding the question of generalization of disease—in tuberculosis, for example—as all the afferents are derived from centripetal lymph ducts, i. e., from ducts that are not connected with any other lymph area. In other words, this lymph area is an isolated area, so that any secondary infection coming into it must first be brought to it through the medium of the blood vessels. Perhaps inflammatory conditions which would cause anastomoses with the lymph vessels of an adjoining region might take place. In this manner pleural lymph radicles could become fused with deep-lying lymph vessels on the pectoral wall, and these vessels in turn pass over the shoulder to the prescapular glands. It would seem that such a roundabout course could hardly take place. Of course, disease of these glands without other centers of infection would point to a primary local infection.

The afferent radicles are derived from the superficial parts of the shoulder, the upper and lower leg, the posterior portion of the lateral pectoral wall (the vessel in this latter case passing to these glands across the muscles of the shoulder), from the superficial parts of the base of the neck, and from part of the inner face of the scapular region.

The efferent vessels pass to the prepectoral lymph glands, i. e., the inferior cervicals.

Usually the glands may be felt in live cattle by pressing the hand forcibly in the hollow of the shoulder, about in front of the neck of the scapula. In a side of beef in the hanging position a small cut, 3 inches in length, parallel to the muscle fibers along the superior border of the mastoido-humeralis muscle, just inward from the shoulder joint, is sufficient for the inspector to reach in and obtain the gland for examination. The muscle can then be laid back in place, flattened out with the hand, and held there with a skewer, so that when the carcass cools it will be scarcely possible to notice any sign that the muscle was disturbed. The gland may also be reached for examination from the inner surface of the split beef carcass by making a longitudinal incision through the neck muscles in the jugular gutter just anterior to the scapulohumeral articulation. This latter method is preferred by many inspectors.

In hogs the gland is most easily reached from the internal or split surface of the carcass by making a transverse cut just in front of the shoulder joint from the nape of the neck to the trachea, some distance anterior to the first rib: the lymph gland will be found to occupy a place about in the middle of the incision.

It is especially important to examine these glands in sheep to detect disease, such as caseous lymphadenitis. In sheep the glands are located as in cattle. (Fig. 8, 9.)

This gland, like the other body glands, is, as a rule, examined in the final inspection of retained carcasses, as exposing it only mutilates the carcass.

#### THE DEEP OR SUPPLEMENTARY CERVICAL LYMPH GLANDS

The deep or supplementary cervical lymph glands in hogs are located above the superficial cervical glands beneath the angular muscle of the scapula, external to the lower part of the second cervical vertebra, embedded in a mass of fat. The afferent vessels are from the deep, muscular layers of the base of the neck. The efferent vessels pass to the superficial cervical or prescapular gland.

In cattle the deep cervical lymph gland does not exist.

The gland in the hog can be reached, after the carcass has been split, by cutting through the neck muscles inferior to the first and second cervical vertebrae. To reach the gland in this manner mutilates the neck somewhat and occasionally the shoulder to a slight extent. In the hanging, split, decapitated carcass, a better way is to make a free upward incision between the neck muscles covering the first and second cervical vertebrae and the layer of superficial fat. This method causes very little mutilation. The gland can then be readily reached in a cushion of fat somewhat anterior to the scapula, torn loose, and brought out for examination.

This gland is considered in the work of the Bureau of Animal Industry as a part of the prescapular group of glands and should be so named in making out reports.

In the superficial parts of the base of the neck and shoulder there are also several other very small but relatively unimportant lymph nodes.

#### THE AXILLARY OR BRACHIAL LYMPH GLANDS

The axillary or brachial lymph glands in cattle are located on the inner aspect of the internal scapular muscles, posterior to the shoulder joint, in the midst of the brachial vessels and nerves where these emerge from the thorax and enter the leg. The glands are variable in number and usually are smaller and more flattened than any of the glands so far described.

In swine the axillary lymph glands are usually missing, and the lymph of this region empties into the median or inferior cervicals.

In cattle the gland may be easily reached from the inner surface of the split carcass, as it lies just external to the first or second rib (usually the latter) at about midway between its two extremities; and by cutting through the muscles along the anterior border of the first rib near its middle the gland may be readily located embedded in a cushion of fat external to the first or second rib. This gland is not examined in the ordinary post-mortem meat inspection.

The axillary glands receive their afferent rootlets from the middle and inner scapular regions, from the lower arm, forearm, and foot, and from the thoracic walls. Their efferent vessels pass to the prepectoral or inferior cervical glands.



## THE PREPECTORAL OR INFERIOR CERVICAL LYMPH GLANDS

In cattle and hogs the prepectoral or inferior cervical lymph glands are located at the entrance to the thorax on or between the lower anterior borders of the two first ribs to the side of and inferior to the trachea and esophagus, usually embedded in fat that also acts as a cushion for the large veins and arteries at that location. (Fig. 1, 7, 8, 9; fig. 4, 21, and fig. 6, b.)

These are very important glands to examine, as they are the terminal glands through which most of the lymph from the head, neck, and fore extremities passes on its way to the thoracic duct and the right lymph vein. They also receive the efferents of the suprasternal lymph glands on their passage to the thoracic duct and of several small lymph nodes in the anterior mediastinal space. They bear the same relation to the anterior portion of the body as do the sublumbar glands to the lymph vessels of the posterior regions. The efferents of the prepectoral glands on the right side empty into the great lymphatic vein, and on the left side into the thoracic duct, or occasionally into the anterior vena cava. These glands are frequently found to be affected with tuberculosis, so that occasionally lesions of that disease may be thus detected even after the viscera have been removed and disposed of.

These glands, or at least a portion of them which practically always remain in the hanging split carcass of beef, may be easily reached by inserting the knife into the cut end of the large, venous trunk referred to above, and making a downward longitudinal incision parallel to the fibers of the long muscles of the neck, where the gland may be readily found embedded a short distance in the fatty cushion.

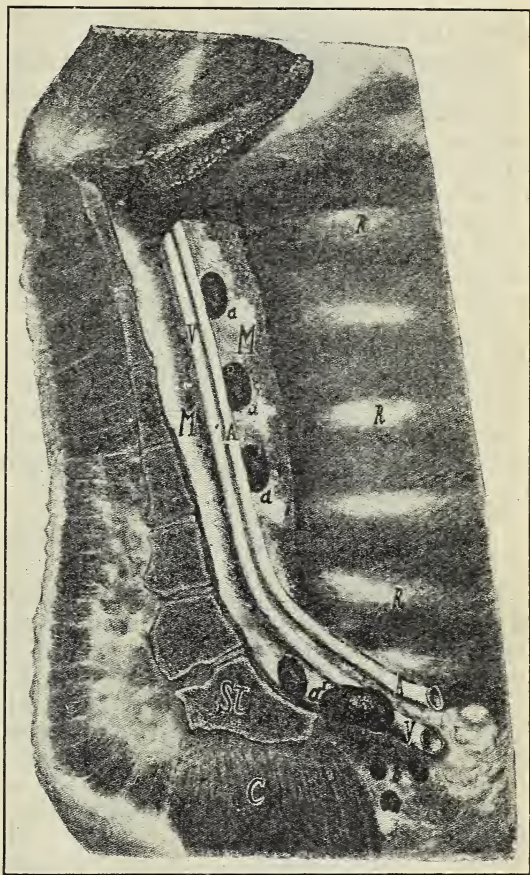


FIG. 6.—Portion of left thoracic wall of heifer. A, internal thoracic artery; V, internal thoracic vein; M, triangular muscle of the sternum cut through; a, inferior thoracic lymph glands; a', anterior mediastinal lymph glands; b, inferior cervical or prepectoral lymph glands. (From Edelmans's Meat Hygiene)

## THE POPLITEAL LYMPH GLANDS

The popliteal lymph glands are located deep in the muscles behind the "knee" joint on the gastrocnemius between the semitendinosus and biceps femoris muscles at about the point of bifurcation of the gastrocnemius. (Fig. 1, 20, and fig. 1, 1'.)

In hogs the popliteals are absent in some instances, but there exists always a very small gland in the subcutaneous tissues 3 or 4 inches above the hock. (Fig. 4, 1, 2.)

The popliteal gland is not examined ordinarily, as it mutilates the carcass considerably to expose it and its examination is not considered necessary except in special cases. To reach it in the hanging cattle carcass, make an incision on the posterior part of the thigh, parallel to the muscle fibers, between the biceps femoris and the semitendinosus muscles, on a line from the point of the ischium to the point of the os calcis, at the intersection of a horizontal line drawn backward from the center of the patella. The fingers may then be thrust in between the muscles to the cushion of fat between the heads of the gastrocnemius, where the gland may be readily located.

The afferent vessels originate in the lower portion of the hind leg. The efferent vessels follow the sciatic nerve, pass upward to a lymph gland (the ischial) lying on the outer portion of the ischium in the middle of the lesser ischiatic notch, thence to the posterior sublumbar gland. At times they pass by this gland without entering it and pass directly to the sacral or sublumbar lymph glands or the internal iliac lymph glands.

## THE ISCHIAL LYMPH GLANDS

The ischial lymph glands are located on the deepest and outer part of the lesser ischiatic notch, adjacent to the external surface of the bone, covered by the broad ligament of the pelvis, on the ventral border of the coccygeal muscle. (Fig. 4, 7.)

The afferent vessels are derived from the surrounding region and from the efferent branches of the popliteal glands. Sometimes the efferents of the popliteals pass very near this gland without entering it.

The efferent vessels of this gland pass to the sacral and sublumbar glands.

## THE PRECRURAL LYMPH GLANDS

The precrural, "kneefold," or external subiliac lymph gland forms a voluminous mass located in the loose cellular tissue of the flank just above and inward from the femorotibial articulation on the anterior border of the tensor fasciae latae muscle.

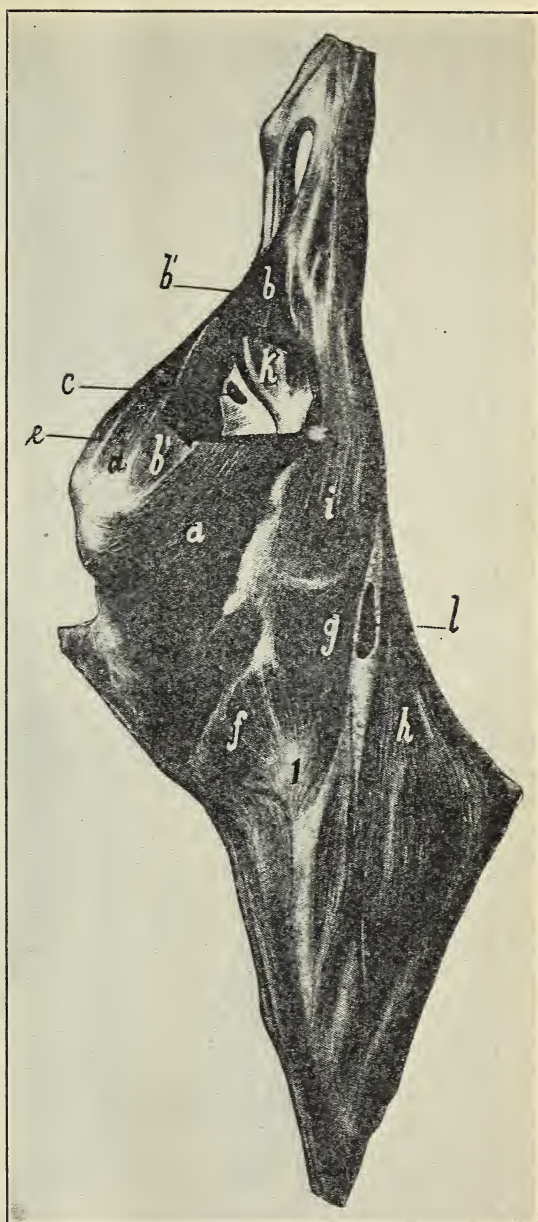
(Figs. 4, 10, and 7, 1.) In animals of good condition it is embedded in a mass of fat. It is one of the most accessible glands in the dressed carcass, and is quite as important from the meat-inspection standpoint as is the prescapular gland in the fore quarters. In sheep this gland is often affected with caseous lymphadenitis, and it is important to keep this in mind and to palpate the gland at the time of inspection. (Fig. 8, 2'.)



The afferent lymph ducts are derived in part from the lateral abdominal wall, in part from the superficial aspect of the thigh and from the outer and superior portions of the hind extremities, also from the large crural muscles.

The efferents pass upward several inches along the fasciae latae muscles through the abdominal wall, and enter the circumflex iliac lymph glands by several large vessels.

In the hog this gland can be readily found with the least mutilation of the carcass by making a free incision through the inner abdominal wall nearly perpendicular to the vertebral column and in front of and above the femorotibial articulation. In cattle it is most easily reached from the external surface of the carcass in the region known to the butcher as the "fell," by cutting down somewhat more deeply than is ordinarily done by the butcher in dressing a beef carcass, or by making a longitudinal incision into the "fell," along the anterior border of the tensor fasciae latae.



THE FLANK LYMPH GLANDS FIG. 7.—Left hind quarter of steer, external view: c, Popliteal lymph gland; l, precrural lymph gland; b, b', biceps femoris muscle; e, semimembranosus muscle. (From Edelman's Meat Hygiene)

In the region of the flank in cattle there is also often a small number of small, subcutaneous glands which receive lymph from the surrounding superficial region. Their efferents pass to the precrurals or to the circumflex

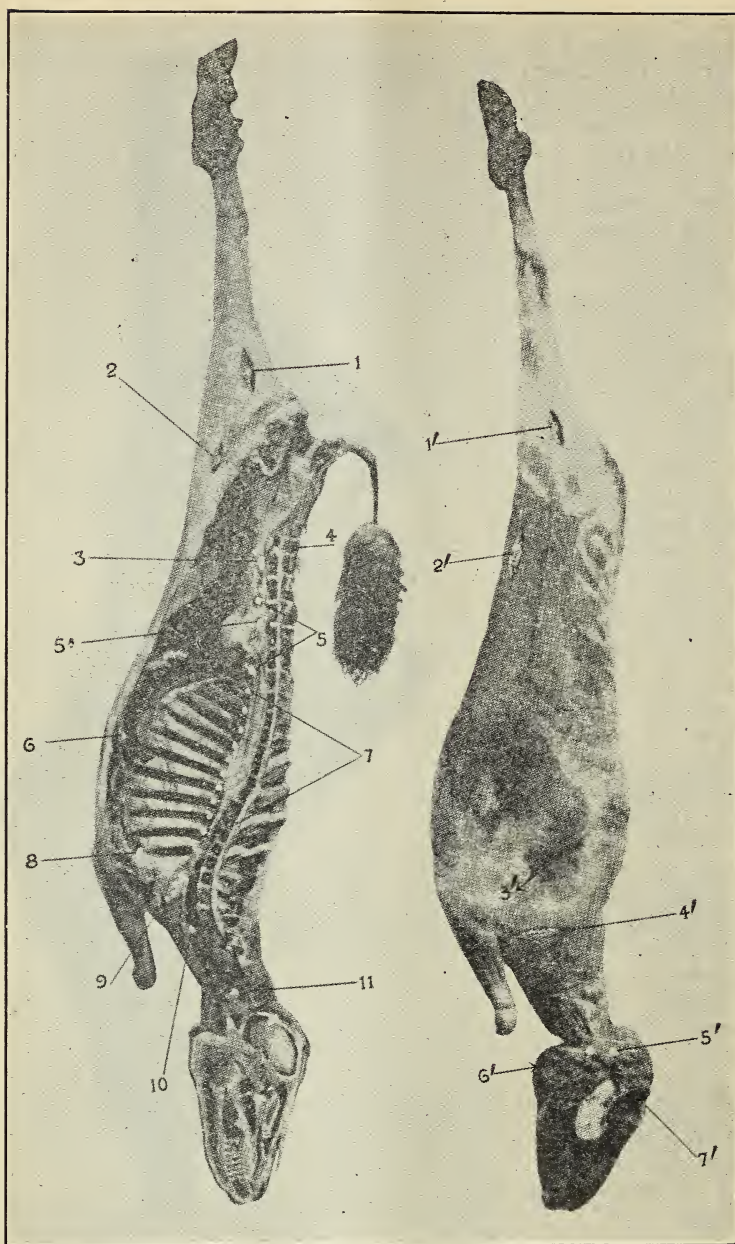


FIG. 8.—Lymph glands in the sheep: 1, 1', Popliteal lymph gland; 2, superficial inguinal lymph gland; 2', precrural lymph gland; 3, internal iliac lymph gland; 4, 5, sublumbar lymph glands; 5a, renal lymph gland; 6, sterno diaphragmatic lymph gland; 7, superior thoracic or subdorsal lymph glands situated along the aorta; 8, suprasternal lymph gland; 4', 9, prescapular lymph gland; 10, small nodes along the superior face of the trachea; 11, superior cervical or postpharyngeal lymph gland; 3', axillary lymph gland; 5', parotid lymph gland; 6', submaxillary lymph gland; 7', atlantal or preatloidian lymph gland. (From Aureggio's Album Guide)



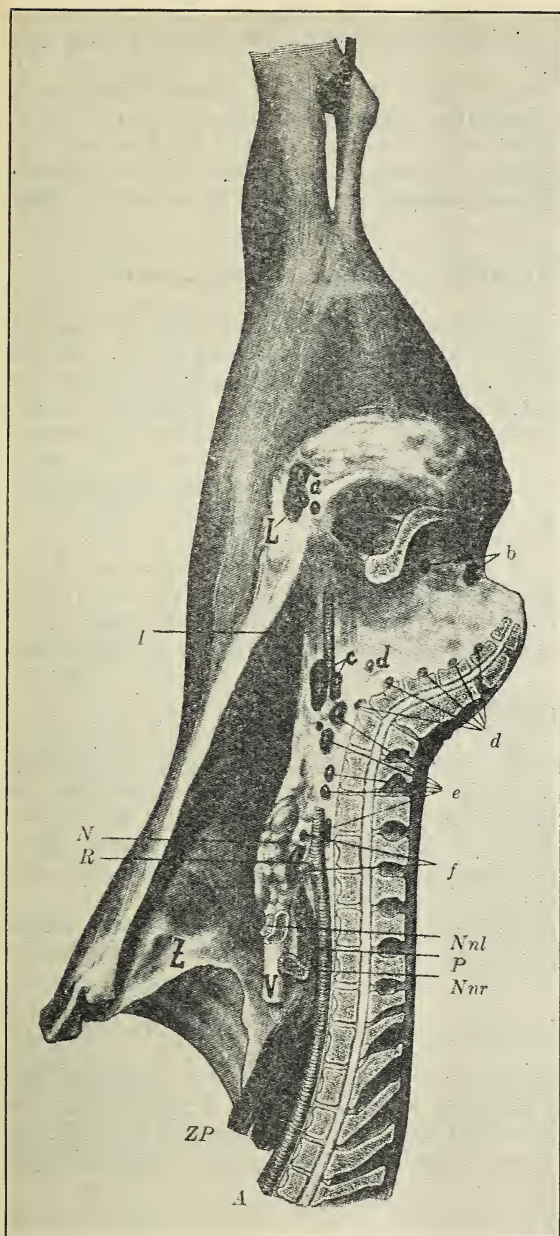


FIG. 9.—Left hind quarter of bull, internal view. *a*, Superficial inguinal lymph glands; *b*, anal lymph gland; *c*, internal iliac lymph glands; *d*, sacral lymph glands; *e*, sublumbar lymph glands; *f*, renal lymph glands. (From Edelman's Meat Hygiene)

iliacs, which are near but on the other side of the abdominal wall.

#### THE SUPERFICIAL INGUINAL AND SUPRAMAMMARY LYMPH GLANDS

The superficial inguinal lymph glands in male cattle are located at the neck of the scrotum beside the penis in front of the inguinal ring; in castrated males they are embedded in the scrotal fat (cod fat).

(Fig. 9, *a*.) In cows these glands are situated bilaterally at the posterosuperior part of the mammary gland and are known as the supramammary lymph glands. (Fig. 1, 21.) In hogs the supramammary lymph glands are located relatively as in cattle, there being one or more nodes on each side posterior to the last segment of the compound mammary glands. (Fig. 4, 5.) Occasionally all or a portion of them are removed when the hams are "faced" on the killing beds, although usually they remain and are found, in the hanging carcass, embedded in fat on a line drawn laterally from the anterior border of the pubis.

The afferent vessels are received from the posterior abdominal wall, the thigh, and the external genitals in the male, and from the posterior abdominal wall,

the thigh, and the mammary gland in the female. The lymphatics of the mammae are very rich and their lymph glands are among the largest of the whole body.

The supramammary lymph glands are of the utmost importance as indicating the state of health or disease of the mammary gland, and on post-mortem inspection of a food animal they should be closely examined, as primary disease of the udder is of common occurrence in hogs, cattle, and sheep, but especially in cattle. (Fig. 8, 2.)

#### THE INTERNAL OR DEEP INGUINAL LYMPH GLANDS

The internal or deep inguinal lymph glands are often absent but are located occasionally in food-producing animals at the site of the entrance of the inguinal vessels into the abdominal cavity on the upper border of the inguinal canal. They are very small and insignificant so far as meat inspection is concerned, but their presence has been demonstrated in young animals by injection with quicksilver. They receive some of the efferent branches of the superficial inguinals. Their efferent vessels pass to the sublumbar glands or direct to the receptaculum chyli.

The deep inguinals in the horse lie at the superior entrance of the inguinal canal surrounding the femoral vessels, and receive lymph from the posterior limb and superficial inguinal glands, while their efferents pass to the internal iliac glands or direct to the receptaculum chyli.

#### THE SACRAL LYMPH GLANDS

Located along the inferior face of the sacrum, near its lateral border, the sacral lymph glands are very small and correspond in position to the glands lying along the spinal column in the dorsal and lumbar regions. (Fig. 4, 9, and fig. 9, d.) They receive their afferents from the coccygeal region, posterosuperior sacral region, and rectum. Their efferents pass to the sublumbar glands.

Along the superior surface of the rectum are numerous small glands whose efferents pass to the sacral glands or to the sublumbar glands.

#### THE EXTERNAL OR CIRCUMFLEX ILIAC LYMPH GLANDS

The external or circumflex iliac lymph glands are located in the angle of bifurcation of the deep circumflex iliac arteries, near the inferior border of the external angle of the ilium and bordering the iliac psoas and external border of the great psoas muscles. (Fig. 1, 18.)

Their afferent vessels are derived from the posterointernal walls of the abdomen, the efferent vessels of the precrucial lymph glands and branches from the lateral surface of the upper part of the thigh. Their efferent vessels pass to the sublumbar lymph glands and through these to the receptaculum chyli.

In cattle the external iliac lymph gland is a single gland about the size of a hickory nut and can be reached only after considerable mutilation of the carcass; consequently it is not ordinarily examined.

#### THE INTERNAL ILIAC LYMPH GLANDS

The internal iliac lymph gland in cattle is a large, heart-shaped gland 2 or more inches in diameter, located at about the upper third of the pelvic arch in the obtuse angle formed by the external iliac artery and the abdominal aorta. (Fig. 1, 19, and fig. 9, c.) In hogs there are several glands at this location, which are continuous with the sublumbar. (Fig. 4, 8, 11.)

The afferent vessels are derived from the precural lymph glands, the superficial inguinal glands, the walls of the posterior abdominal and pelvic cavities, and from the rectum, internal genital organs, urinary bladder, pelvis, and sacrum. Some of the efferent vessels pass to the sublumbar glands and some direct to the receptaculum chyli.

In a hanging beef carcass this gland may be easily felt by placing the hand on the inner face of the ilium at about the upper third of the border of the pelvic arch.

#### THE ANAL LYMPH GLANDS

The anal lymph glands are very small glands located in the fatty tissue on the floor of the pelvis laterally from the anus. (Fig. 4, 3, and fig. 9, b.) The afferent vessels are derived from the anal region, the root of the tail, and surrounding tissues. The efferent vessels pass to the sacral and sublumbar lymph glands.

#### THE SUBLUMBAR LYMPH GLANDS

The sublumbar glands are located in the sublumbar region along each side of the abdominal aorta and are usually embedded in the fatty cushion bordering the large blood vessels of the sublumbar region. (Fig. 1, 17; fig. 4, 5; fig. 8, 4 and 5; fig. 9, e; fig. 11, 13.)

The afferent lymph radicles penetrate the lumbar muscular masses and the posterosuperior abdominal walls. These glands also receive the lymph from nearly all the glands lying posterior to them, i. e., the internal iliac, circumflex iliac, and sacral glands, and from the internal sexual organs, lumbar vertebrae, and urinary apparatus. It will thus be seen that these are important glands, as they receive lymph from all the lymphatic vessels of the posterior limb, pelvis, abdominal walls, and the inguinal region.

The efferent vessels pass to the receptaculum chyli, lying just beneath the kidneys amid the suspensory ligaments of the abdominal visceral organs.

#### THE RENAL LYMPH GLANDS

The renal lymph glands in cattle are located in the fatty tissue in the hilus of the kidney on the course of the renal artery. (Fig. 9.) In swine they are located on each side of the renal artery where it branches off from the aorta. These glands consist of several small nodes, usually a node anterior and two posterior to the renal artery



and not far from the hilus of the kidney. The afferent vessels are derived from the kidneys. The efferent vessels pass directly into the receptaculum chyli, which lies immediately adjacent to these glands.

### THE GASTRIC LYMPH GLANDS

The gastric lymph glands are located in cattle in the folds and fissures of the divisions of the compound stomach, especially between

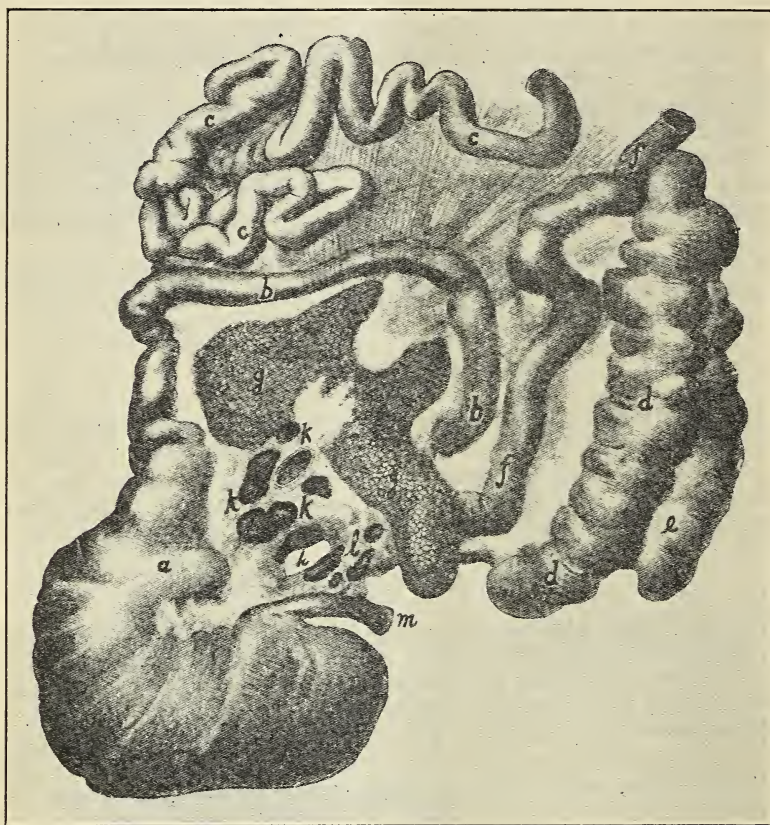


FIG. 10.—Stomach and portion of intestinal canal of hog: *a*, Pyloric portion of stomach; *b*, duodenum; *c*, jejunum; *d*, cecum; *e*, colon; *f*, rectum; *g*, pancreas; *h*, foramen of Winslow; *i*, portal vein; *k*, hepatic lymph glands; *l*, gastric lymph glands. (From Edelmann's Meat Hygiene)

the second stomach and the fourth or true stomach, and on the course of the gastric blood vessels. In cattle they are sometimes called the glands of the paunch. On the great curvature of the fourth stomach there are a number of small nodes, also.

In swine the gastric glands are large and three or four in number. They are located in the lesser curvature of the stomach and are covered by the pancreas. (Fig. 10, 1.)

The afferents are derived from the superficial parts of the walls of the stomach and from the submucosa of the stomach. The efferent conduits pass upward through the gastric omentum into the recep-



taculum chyli. A small lymph area on the fundus of the stomach of the hog passes up through the gastrosplenic ligament to the splenic lymph gland lying in the hilus of the spleen.

#### THE MESENTERIC LYMPH GLANDS

The mesenteric lymph glands in cattle are located in the "ruffle fat," along the lesser curvature of the intestines in the folds of the mesentery, and consist of a continuous chain of glands from the abomasum to the cecum. (Fig. 12, m.) These glands are cylindrical segments and vary in size and consistence according to the stage of digestion, being more voluminous and containing a greater fluid content immediately after or during the digestive period.

This chain of glands in swine is very similar to those in cattle, except that the glands are much further removed from the intestines, being near the middle of the mesentery. (See fig. 13, G.)

In sheep the mesenteric glands are disposed as in cattle. They do not contain many interrupted nodes, however, but are long, cylindrical structures which have the appearance of being fused into one long, continuous mass.

To detect tuberculosis in cattle and hogs an examination of these glands is very important, as one or all of them frequently present lesions of this disease, and in quite a number of cases, especially in hogs, they are affected when no other lesions of the disease can be found in the carcass. With a few deft strokes of the knife, an experienced inspector can cut into and lay open for examination a considerable number of these mesenteric glands in the hog, but some skill is required in order to throw the intestines in just the right position on the table so as to be able to make the examination quickly. This knack is very essential in the large slaughterhouses where rapid killing is the rule.

The afferent lymph radicles are derived from the very rich lymph and chyle plexuses in the submucosa of the intestines. It is through the medium of these vessels that the chyle is transported. The chyme of the intestines furnishes the lacteals or intestinal villi with the material from which the chyle is abstracted, and this passes through these structures to the chyloferous capillary plexuses in the intestinal wall, then into the afferent vessels of the mesenteric lymph glands. The efferent vessels of these glands—sometimes called lacteals, from the milky appearance of their liquid contents—pass through the whole width of the mesentery to the receptaculum chyli.

Also on the colon there are a number of small lymph glands, lying in the folds, which receive the lymph from the walls of the colon and pass it on to the efferent vessels which convey it to the receptaculum chyli.

#### THE SPLENIC LYMPH GLANDS

The splenic lymph glands in swine are located in the gastrosplenic ligament at the hilus of the spleen near the superior extremity. In bovines these glands lie at the hilus of the spleen between the folds of the splenic ligament, and when the spleen is removed the glands often remain adherent to the paunch. The afferent lymph vessels are derived from the superficial and deep portions

of the spleen, and in the hog also from the fundus of the stomach. In cattle, also, no doubt, a few lymph radicles are derived from the stomach walls. The efferents pass to the receptaculum chyli.

#### THE HEPATIC OR PORTAL LYMPH GLANDS

The hepatic or portal lymph glands, from three to five in number, are located in cattle on the posterior surface of the liver, and are embedded in the fatty cushion surrounding the vessels entering at the portal fissure. (Fig. 11, c.) In hogs they lie on the portal vein around the foramen of Winslow, and are usually separated from the liver during evisceration, being generally removed with the intestines, and are then readily found in the fat near the gastric lymph glands. They should invariably receive careful examination. (Fig. 10, k.)

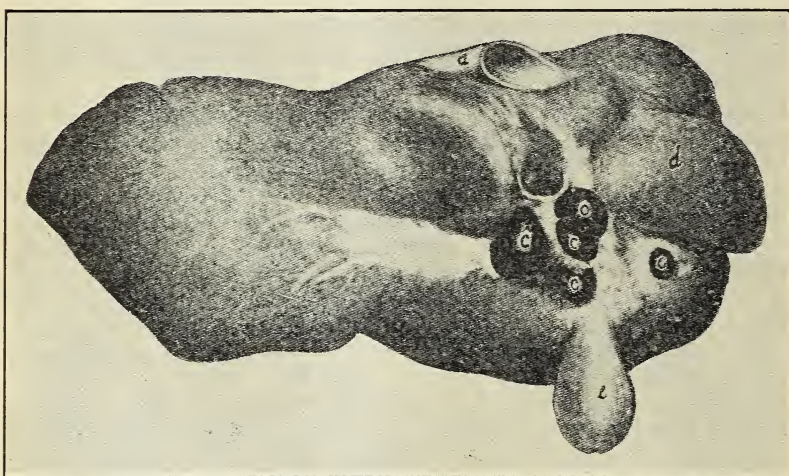


FIG. 11.—Gastric surface of the liver of cattle: *a*, Vena cava; *b*, entrance of the portal vein; *c*, portal lymph glands; *d*, lobe of Spigelius; *e*, gall bladder. (From Edelmänn's Meat Hygiene)

The afferent lymph vessels are from the greater portion of the anterior surface, all of the posterior surface, and from the entire glandular portion of the liver. The efferent vessels pass upward along with those from the stomach to empty their contents into the receptaculum chyli.

#### THE SUPERIOR THORACIC OR SUBDORSAL LYMPH GLANDS

The superior thoracic or subdorsal lymph glands in cattle are located in the intercostal spaces, embedded in the intercostal muscles and covered by the costal pleura, along each side of the dorsal vertebrae. Their afferent vessels are derived from the intercostal muscles, dorsal muscles, dorsal vertebrae, parietal pleura, and partly from the periosteum and the diaphragm. The efferent vessels pass forward and empty into the thoracic duct. (Fig. 1, 13.)



In sheep and hogs these glands are absent, but a chain of lymph glands lies on the aorta just under the dorsal vertebrae. (Fig. 8, 7.)

#### THE INFERIOR THORACIC OR SUPRASTERNAL LYMPH GLANDS

The inferior thoracic or suprasternal lymph glands are located along the course of the internal thoracic vein and artery and are covered by the triangularis sterni muscle at the lower end of the intercostal spaces and lying superior to the sternum.

The afferent lymph vessels are derived from the rectus abdominis, intercostal muscles, parietal pleura, and diaphragm. The efferent vessels pass to the prepectoral lymph glands in order to gain the thoracic duct, or to the thoracic duct or right lymphatic trunk direct.

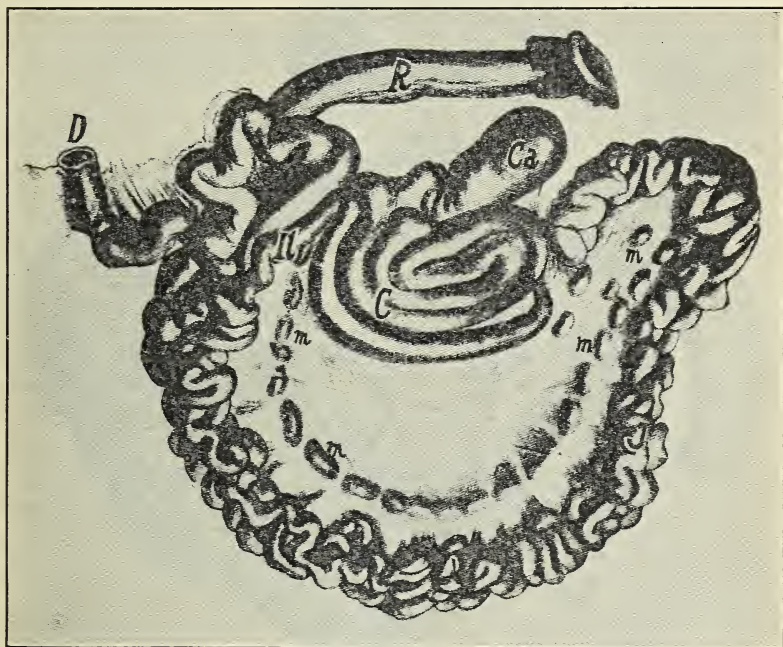


FIG. 12.—Intestinal canal of cattle spread out: *C*, Colon; *Ca*, cecum; *D*, duodenum; *J*, jejunum; *Il*, ileum; *R*, rectum; *m*, mesenteric lymph glands of the small intestines. (From Edelmann's Meat Hygiene)

It is important to note that in cattle one of the suprasternal glands is sometimes designated the sternodiaphragmatic gland, but this gland is not located in the inferior thoracic chain. It is embedded in the fatty tissue at the junction of the diaphragm with the sternum. Afferents are derived from the pleura and diaphragm, and efferents pass to the suprasternals. (Fig. 1, 11, 12, and fig. 6, a.)

In swine the suprasternals are usually absent, but in their stead is a large, single gland at the articulation of the first and second segments of the sternum. (Figs. 4, 19.) In sheep there is a sternodiaphragmatic gland and a gland disposed in the same manner as in the hog, i. e., just above the first or second segment of the sternum. (Figs. 8, 6, 8.)



## THE LYMPH GLANDS OF THE THORACIC VISCERA

The lymph glands of the thoracic viscera may be divided into tracheobronchial, and mediastinal. The tracheobronchial glands are located on the walls of the trachea near the branching of the main bronchial tubes, which are given off to the different lobes of the lungs, and are named accordingly. The mediastinal glands are termed anterior or posterior, according to whether they are anterior or posterior to the heart. The anterior and posterior mediastinals are

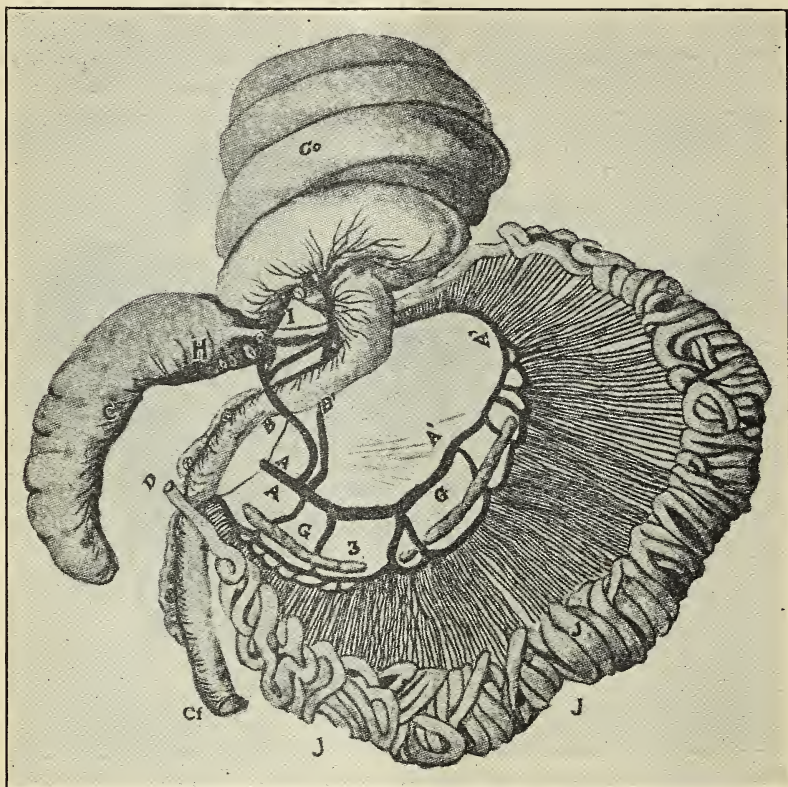


FIG. 13.—Arteries and lymph glands in the intestines of the hog: A, Great mesenteric artery; A', arteries of the intestinal mesentery and its subdivisions; J, small intestines; C, cecum; Co, colon; G, mesenteric lymph glands forming a chain along the vascular arches of the mesentery; H, group of lymph nodes along the course of the cecal artery; K, several small lymph nodes on the colic artery. (From Aureggio's Album Guide)

not of the same significance in human beings as in cattle, sheep, and hogs. The posterior mediastinum in man corresponds to both anterior and posterior mediastina of domestic animals. It has been thought best to designate the large gland at the anterior portion of the posterior mediastinal space as the median mediastinal gland.

The groups of glands in the region of the lungs (bronchials and mediastinals) are very important to the inspector and should be carefully examined in every case before a carcass is passed for food, as tuberculosis is frequently found in one or all of them, especially in

cattle, where these glands seem to be a favored seat of infection. In sheep especially these glands often show the lesions of caseous lymphadenitis.

In hogs the bronchial glands are very well developed and are found usually in pairs in relatively the same location as in cattle. In hogs the efferent vessels pass directly to the thoracic duct.

Along the course of the phrenic nerve as it passes the base of the heart are many small, reddish lymph glands embedded in the fatty tissues on either side of the nerve.

Against the pericardial sac just under the trachea is a gland which receives the vessels from this portion of the trachea and visceral pleura. Also on the visceral pleura against the inner surface of the left lung lies another small node which receives afferents from the adjacent tissues.

F. A. Imler, formerly in charge of meat inspection at Cairo, Ill., calls special attention to the presence, in the hog, of a gland, already known to some bureau inspectors, which varies in size from that of a small pea to that of a pecan and is located between the folds of the visceral pleura and not infrequently in the lung substance on the lower median border of the lung, about 1 inch from its union with the superior median border. Its occurrence is variable, but usually it is found more frequently in the right than in the left lung, and, though seldom, a node may be present in each lung. Imler reports this gland present in from 80 to 90 per cent of all hogs, but observations made by the authors, covering several thousand hogs, show it to be present in about 12 per cent of them. It appears to receive its afferent vessels from the lung substance, mediastinal pleura, and the liver, as disease of these parts causes alteration in the glands.

#### THE RIGHT ANTERIOR BRONCHIAL LYMPH GLAND

The right anterior bronchial lymph gland in cattle is located at the junction of the bronchus of the right supernumerary or cephalic lobe with the trachea, and is anterior or somewhat inferior to the bronchus. (See Fig. 14, a.) In hogs it is anterior and adjacent to the bronchus. (See Fig. 15, 2.) The afferent vessels are derived from the right anterior lobe. The efferent vessels pass to the large gland located at about the middle of the posterior mediastinal region, which may be called the median mediastinal, or to the other anterior nodes of this group, then to the thoracic duct.

#### THE RIGHT POSTERIOR BRONCHIAL LYMPH GLAND

The right posterior bronchial lymph gland in cattle is located at the junction of the bronchus of the right main lobe of the lung with the trachea, and is most easily found by turning the lung bottom side up, as it lies under the bronchus. For the location in the hog see Figure 15, 2. The afferent lymph vessels are derived from the main right lobe. The efferents pass to the median mediastinal glands, thence to the thoracic duct.

#### THE LEFT BRONCHIAL LYMPH GLAND

The left bronchial lymph gland in cattle and hogs is located on the left side of the trachea, anteriorly to and near the left bronchus,



and is normally the largest of the bronchial lymph glands. (Figs. 14, b. and 15, 3.) It receives its afferent lymph vessels from the left lobe of the lung and empties its efferent vessels into the anterior mediastinal glands on the way to the thoracic duct. The bronchial glands of the hog are usually found in pairs. In cattle there is usually a large, single gland, rather deeply lobulated, so that

it appears almost like several glands grouped together. This gland is the one ordinarily examined on the killing beds, the procedure being to grasp the anterior lobe of the left lung with one hand and with the other to make an incision across the left bronchus at the root of this lobe so as to cut into and expose the lymph gland for examination.

#### THE POSTERIOR OR MIDDLE BRONCHIAL LYMPH GLAND

The posterior or middle bronchial lymph gland, located in cattle at the posteroinferior part of the bifurcation of the trachea into the two main bronchi, is a very small gland and is absent in some animals. (Fig. 1, 16.) It is always present in hogs, on the superior part at the bifurcation of the trachea. Afferents are received from the mediastinal pleura and bronchi, and efferents pass to the anterior mediastinal glands.

Sometimes there are several small glands in close proximity at this location, and they probably receive lymph from the deeper lung tissues of the posterior lobes, from the adjacent parietal and visceral pleura, and from the diaphragm. Their efferent vessels pass along the internal face of the left principal lobe and empty into a small gland in the anterior mediastinum just above the base of the heart,

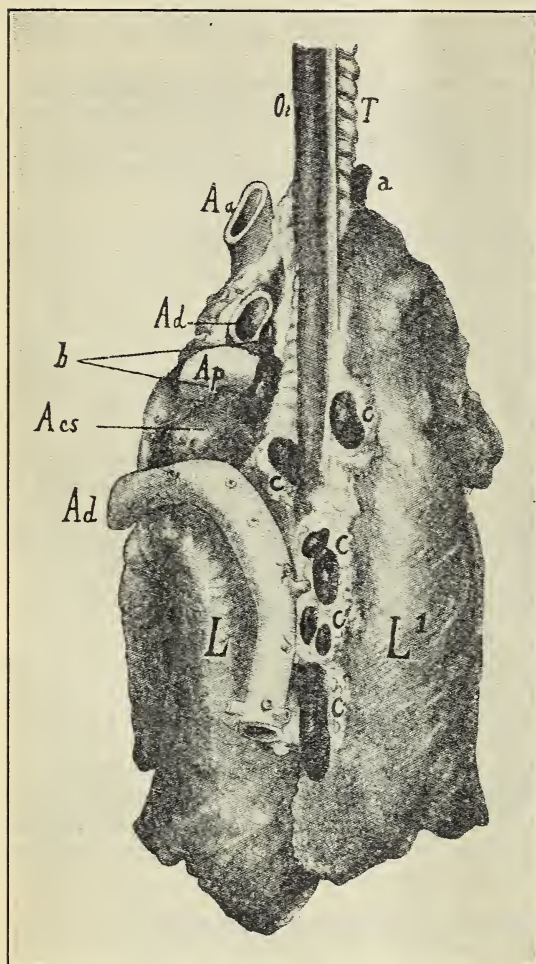


FIG. 14.—Lungs and heart of steer, suspended, dorsal view: *Aa*, Anterior aorta; *Ap*, pulmonary artery; *Ad*, posterior aorta; *Acs*, left auricle; *L*, left lung; *L'*, right lung; *a*, right anterior bronchial lymph gland; *b*, left bronchial lymph gland; *c*, median and posterior mediastinal lymph glands. (From Edelmann's Meat Hygiene)



thence forward to one of the glands at the apex of the pleural sac, or into the thoracic duct.

#### THE ANTERIOR MEDIASTINAL LYMPH GLANDS

The anterior mediastinal lymph glands are located in the folds of the anterior mediastinum in variable numbers. They are small and are distributed along the inferior and lateral parts of the trachea and esophagus anterior to the heart and near to the entrance to the thorax. (Fig. 1, 15, and fig. 6, a'.)

Their afferents are derived from the pleura, esophagus, pericardium, and heart, and the efferent vessels from posterior or middle bronchials, thymus, and small glands along the course of the phrenic nerves. Their efferents pass either to the thoracic duct or right lymphatic vein or to the prepectoral vein before entering the large terminal lymph trunks.

These glands as a rule remain in the beef carcass after the lungs are removed, and, in the dressed carcass, the whole group is sometimes found on one side after it is split, while in other cases one-half of the gland or glands is found on each half of the carcass, embedded in the mass of fat just superior to the anterior segment of the sternum.

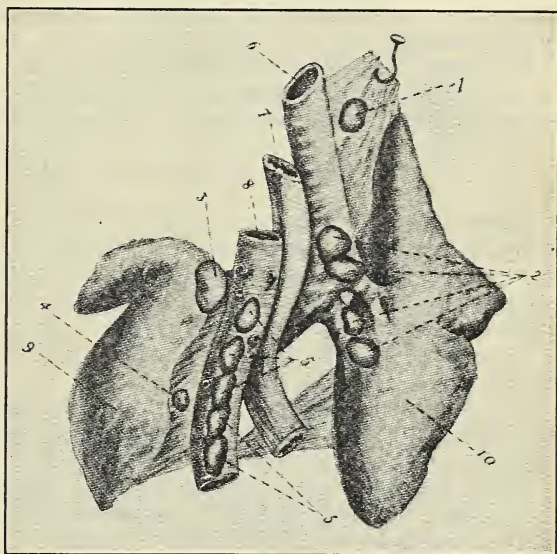


Fig. 15.—Lungs of hog, showing attached lymph glands: 1, Lymph gland on pleura adjacent to pericardial sac; 2, Right anterior and posterior bronchial lymph glands; 3, Left bronchial lymph gland; 4, Lymph gland attached to mediastinal pleura between aorta and left pulmonary lobe; 5 Lymph glands on superior face of aorta peculiar to hogs and taking place of posterior mediastinal chain of glands in bovines. (From Aureggio's Album Guide)

#### THE MEDIAN MEDIASTINAL LYMPH GLAND

The median mediastinal lymph gland in cattle is located in the anterior part of the posterior mediastinal space, and is an anterior node of the posterior mediastinal group. It is well developed and is a very important gland, as it receives the efferent lymph vessels of the principal bronchial glands, as before described. The efferent vessels empty directly into the thoracic duct, with which it is in very close proximity. (Fig. 14, c.)

#### THE POSTERIOR OR CAUDAL MEDIASTINAL LYMPH GLAND

The posterior or caudal mediastinal lymph gland in cattle is located at the extreme posterior portion of the posterior mediastinal region, touching the pillars of the diaphragm. It is the largest of all the thoracic glands and of those known usually as the posterior

mediastinal group. (Fig. 14, c.) Other nodes also are found in the posterior mediastinal group.

The afferents are derived from the pleura of the surrounding posterior mediastinal region, the diaphragm, the esophagus, and the anterior face of the liver. The efferents pass forward to near the median mediastinal gland, then empty into the thoracic duct.

This gland is frequently left in the dressed carcass, in which case it will be found close to the diaphragm, adjacent to the pillars of this muscle, and should invariably be removed and examined, as it is a frequent seat of tuberculous lesions. The anterior node of the posterior mediastinals (the median mediastinal) is also occasionally left in the carcass, where it can be found attached to the inferior dorsal muscles to the right of the aorta about opposite the interspace between the fourth and fifth ribs. This portion of the gland is often erroneously considered by inspectors to be the anterior mediastinal lymph gland.

In hogs, along the superior surface of the aorta, are four or five small lymph glands which may be regarded as corresponding to the posterior group of mediastinal lymph glands found in bovines.

#### OTHER LYMPHATIC STRUCTURES

Besides the lymphatic structures described above, there are many lymphatic tissues throughout the animal, of which brief mention should be made. In some of the organs of the body there are lymphatic cellular aggregations more or less extensive, yet hardly large enough to be classed as lymph glands.

Very small lymph glands are found along the course of the smaller bronchi in the lungs.

The spleen is very rich in lymphatic tissues which compose the Malpighian bodies that are so prominent on section of that organ and appear as small, whitish nodules in the red matrix.

In the intestines the lymphatic tissues compose what are known as the solitary follicles and the agminated follicles or Peyer's patches. In the terminal part of the small intestines of the hog a Peyer's patch forms itself as a band from 4 to 5 feet in length.

In the mucous membranes of other parts also are many lymph follicles, as in the soft palate and the base of the tongue, but particularly in the tonsils and in the posterior nares.

It may be well to call attention to spaces surrounding blood vessels of the brain, known as perivascular lymph channels, and around nerve trunks, called perineural lymph sheaths; but these spaces are not dependents of the large lymph system.

Both the pleural and the peritoneal cavities are thought to be in open communication with the lymph vessels; in the case of the pleura the openings occur in the intercostal spaces, and in the case of the peritoneum on the pillars of the diaphragm. The openings of communication are called stomata. Normally, these cavities contain only sufficient lymph to lubricate the contained viscera.

Stroh has described a small lymph gland, in cattle, located at about the juncture of the xiphoid cartilage and the cartilage of prolongation of the last rib.

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June 18, 1928

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